4.4 The Pythagorean Theorem and the Distance Formula

Goal Use the Pythagorean Theorem and the Distance Formula.

VOCABULARY

Legs of a right triangle

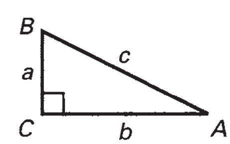
Hypotenuse

Distance Formula

THEOREM 4.7: THE PYTHAGOREAN THEOREM

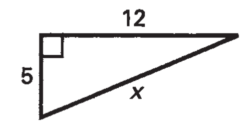
Words In a right triangle, the square of the length of the ____________ is equal to the sum of the squares of the lengths of the legs.

Symbols If $m\angle C = 90°$, then $c^2 =$ ___ + ___.



Example 1 *Find the Length of the Hypotenuse*

Find the length of the hypotenuse.



Solution

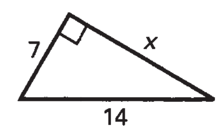
Use the Pythagorean Theorem to write an equation of the form $(\text{hypotenuse})^2 = (\text{leg})^2 + (\text{leg})^2$.

$x^2 = (\_\_)^2 + (\_\_\_)^2$	**Substitute.**
$x^2 = \_\_\_ + \_\_\_\_$	**Multiply.**
$x^2 = \_\_\_\_$	**Add.**
$\sqrt{x^2} = \_\_\_\_\_$	**Find the positive square root.**
$x = \_\_\_$	**Solve for x.**

Answer The length of the hypotenuse is ___.

Example 2 *Find the Length of a Leg*

Find the unknown side length.



Solution

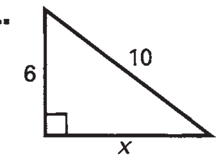
Use the Pythagorean Theorem to write an equation of the form $(\text{hypotenuse})^2 = (\text{leg})^2 + (\text{leg})^2$.

$(\_\_\_)^2 = (\_\_)^2 + (x)^2$	**Substitute.**
$\_\_\_\_ = \_\_\_ + x^2$	**Multiply.**
$\_\_\_\_ = x^2$	**Subtract ___ from each side.**
$\_\_\_\_\_ = \sqrt{x^2}$	**Find the positive square root.**
$\_\_\_\_ \approx x$	**Approximate with a calculator.**

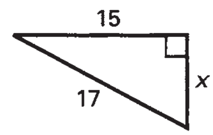
Answer The side length is about _____ units.

Checkpoint Find the unknown side length.

1.



2.



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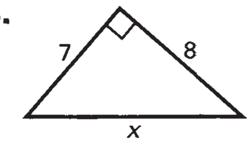
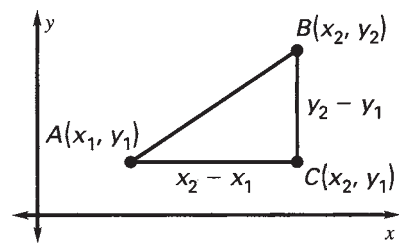


THE DISTANCE FORMULA

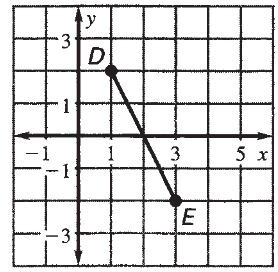
If $A(x_1, y_1)$ and $B(x_2, y_2)$ are points in a coordinate plane, then the distance between A and B is

$AB = \sqrt{(\underline{\qquad\qquad})^2 + (\underline{\qquad\qquad})^2}$.



Example 3 *Use the Distance Formula*

Find the distance between $D(1, 2)$ and $E(3, -2)$.



Plot points D and E in a coordinate plane. Let $D(1, 2)$ be (x_1, y_1), so $x_1 =$ __ and $y_1 =$ __. Let $E(3, -2)$ be (x_2, y_2), so $x_2 =$ __ and $y_2 =$ ____.

$DE =$ ______________________	**Distance Formula**
$=$ ____________________	**Substitute.**
$=$ ____________	**Simplify.**
$=$ _____	**Add.**
$\approx$ ____	**Approximate with a calculator.**

Answer The distance between D and E is about ____ units.

Follow-Up

Can Example 3 be done using the Pythagorean Theorem rather than the Distance Formula? Explain.

Checkpoint **Find the distance between the points.**

4.